USDA/NASA Workshop
Breakout Synthesis Report

Focus Area: **Air Quality**

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Number of Breakout Groups: 1

Total Participants: 20

Part 1 – Requirements Definition
Part 2 – Research & Data Relevance
Part 3 – Gap Identification
Part 4 – Collaborative Opportunities

Overall Comments:

1. USDA concern for air quality relates to:
   - Regulatory environment including the Clean Air Act and Regional Haze
   - Human/farmer and livestock health
   - Agricultural yield and production

With improved data and models, NRCS can improve the recommendations it makes to the farming community.

2. Primary AQ management issues are:
   - What is agriculture's contribution to ambient levels of National Ambient Air Quality Standards as set by EPA? *(USDA support to farmers on this topic)*
   - How can agriculture quantify the effectiveness of conservation practice standards and other abatement strategies?

3. Based on farmer input USDA/NRCS is immediately interested in agriculture's contribution to air quality/pollution and secondarily interested in effects of air quality/pollution on crop health and agricultural production.

4. Gaps in satellite's ability to observe emissions from individual agricultural activities from space. Potential to observe with airborne assets & improve emissions inventories needed for models

5. From the USDA/NASA discussions, the Air Quality Focus Area identified that, by and large, NASA approaches air quality issues from above (air/space) while USDA approaches the issues from the ground. As such, there are significant opportunities for collaboration, such as USDA providing ground-truthing to air quality models and airborne/space data. There are significant differences in temporal and spatial resolutions needed and available from observations and model outputs.

PART 1 – Requirements Definition

What are USDA's policy and program needs that might be fulfilled with earth science and remotely sensed information?

USDA concern for air quality relates to:

- Regulatory environment including the Clean Air Act and Regional Haze Rule
- Human/farmer and livestock health,
- Agricultural yield and production,

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- Aerosols
  - especially PM 10 and 2.5, precursors (NH3), visibility
- Ozone
  - including VOCs, NOx
- Greenhouse Gases (GHGs)
- Odor *
- Impact on agriculture and forestry – of secondary immediacy

With improved data and models, NRCS can improve the recommendations it makes to the farming community. More specifically these will support national conservation practice standards, compliance with NAAQS, nutrient management recommendations, and other aspects of agricultural production, abatement technologies, and aid with assessment of programmatic effectiveness on airshed and/or regional scales.

* To large degree, Odor issue will be accomplished within the context of top three issues.

PART 2 – Research and Data Relevance

What is the state-of-the-research (USDA and NASA) and current NASA measurement and modeling capabilities that are relevant to these needs?

Aerosols:

USDA: Understands control & management of PM

NASA: Global/regional/local spatial distribution (25-40 km)
Vertical distribution w/in 150m
More intense the plume, the easier to characterize
Fire detection - MODIS products (on going with USFS)
Models: Global - to ½ degree (e.g. GEOS)
Meso/Regional - to 1km (e.g. MM5)
Local - <1 km (other agencies - DOE, NOAA)

Missions/Sensors: MODIS & MISR

Ozone

USDA: Understand plant responses to ozone
Emission factors - limited to off-road engines
Understands basic soil biological processes
Operate UV-B networks

NASA: Observe/model the large scale patterns
Satellites can observe soil NOx in agricultural belts
- Not to individual agricultural areas/practices
Underestimation between measurement and models on NOx
Limited information available regarding the boundary layer
Significant improvements with AURA (TES/OMI) in 2004
Identification/documentation of major/catastrophic events
- E.g. long range transport of Gobi desert dust
Expected near term capabilities: daily retrievals at 25 km

Missions/Sensors:
TOMS
GOME & Schiamacy (European – support proof of concept)
Aura (OMI / TES) – Launch in 2004

PART 3 – Gap Identification

What are the gaps in existing knowledge and research pertaining to the ability of earth science to address the USDA needs?

Aerosols:

- USDA needs aerosols at <1km resolution.
- Need particle size distribution and source speciation (significant improvements expected 2006/2007)
- Maintain annual databases to observe trends
- NH3 emission actors – with daily and climatic variations at local/regional levels – ¼ to ½ degree to support regional/local efforts
- Improved dispersion models developed or adapted for agricultural purposes (NASA models down to ground level; USDA goes to other agencies to go to ground level); NASA can contribute better weather data to the models.
- Emission factors of agricultural activities and their validation.
- Characterization of speciation/distribution relative to animal feeding operations as sources.

Ozone:

- VOC emissions for agriculture not completely understood.
- Higher resolution of (3-D spatial and temporal) of ozone profiles
  - Need at least 2 points in and out of boundary layer
- Ground based upward looking instruments for CO2, NH3, CO, HCHO, O3

PART 4 – Collaborative Opportunities

What are the opportunities for collaborative/cooperative R&D efforts between USDA and NASA to develop products and solutions that serve decision makers?

Aerosols:

- NASA – help define emissions inventories and boundary conditions to the models
    - Boundary for models? Airshed boundaries?
- NASA aerosol distributions coupled with USDA datasets (soils, land-cover, and management practices) to produce a PM potential emissions inventory.
- Collaboration on ground measurement of soil moisture by USDA (SCAN and others) with satellite measurement by NASA (GWEX)
- NASA – provide inputs to models (evapotranspiration, surface heat flux, etc.) to agricultural air quality models.

Ozone:

- Connect UV-B networks with TOMS and Ozone NOx activities.
- NASA – help define emissions inventories and boundary conditions to the models (satellite and airborne)
- Add USDA role to NASA's North American Field Campaign for Air Quality and greenhouse gases
- Collaboration to provide NASA technical expertise and instruments and USDA field personnel (e.g. ozone-sondes)
- Airborne system for small scale process studies
    - especially exploiting LIDAR